

Commonwealth of Kentucky
Division for Air Quality
PERMIT STATEMENT OF BASIS

CONDITIONAL MAJOR (DRAFT PERMIT) No. F-06-033

BLUEGRASS BIOENERGY, LLC

904 KENTUCKY AVENUE, FULTON, KENTUCKY

JULY 13, 2006

IL-WON SHIN, REVIEWER

SOURCE I.D. #: 021-075-00027

SOURCE A.I. #: 80142

ACTIVITY #: APE20060001

SOURCE DESCRIPTION:

Bluegrass Bioenergy, LLC (Bluegrass) is a proposed new ethanol production facility in the City of Fulton, Fulton County, Kentucky. The facility will have the potential to manufacture 60,000,000 gallons of denatured, fuel grade ethanol per year. As part of the process, the facility will produce animal feed as a co-product. The animal feed, known as distiller's grain and solubles (DGS) can be sold as is (wet cake), dried completely (DDGS), or partially dried (modified wet cake).

The Bluegrass ethanol facility will purchase feedstock (corn, milo or other) and will receive it at the facility by truck and rail. A high efficiency baghouse (**Source ID#, S1**) will collect and control particulate emissions associated with grain unloading operations. Mechanical conveyors will move the grain from receiving to storage, storage to milling, and milling to mixers. The high efficiency baghouses will be connected to these conveyors as well; to ensure particulate emission controls for all grain processing areas. Collected grain dust will be returned to the process downstream of the hammermill. A hammermill is a dry milling process that will be used to mill the grain into a powder. Hammermill particulate emissions will be controlled by a high efficiency baghouse (**S2**). Dust collected by the milling baghouse will be injected into the mixers.

In the mixer, the powdered of grain will be mixed with recycled process water from the cook water tank to form a slurry. The slurry will be cooked to liquefy and breakdown the starch to sugars. The slurry will be cooled with non-contact cooling water and conveyed to fermenter process vessels where yeast and enzymes will be added. The fermentation process will convert the sugars to ethanol and carbon dioxide (CO₂) and produce a fermented mash or slurry called beer. The beer will be pumped from the fermenters to the beer well. The beer well is a process tank that will provide a continuous flow of the beer slurry to the degasser, beer column, B/C condenser and the distillation (rectifier) column. The CO₂ from the fermenters and the beer well will pass through a high efficiency CO₂ scrubber before the CO₂ is exhausted through the scrubber stack (**S5**). The water from the scrubber will be pumped to the cook water tank and recycled back to the process.

The beer will contain about 10% ethanol in addition to non-fermentable corn solids. The ethanol will be separated from the beer by distillation and leave the distillation section as 190 proof ethanol. The 190 proof ethanol will be stored in an internal floating roof tank (TF1). At this point in the process, the ethanol will contain residual water. To remove the excess water, the 190

proof ethanol will be passed through a molecular sieve resulting in 200 proof ethanol. The 200 proof ethanol will be sent to an internal floating roof storage tank (TF2). The final process step will mix the 200 proof ethanol with natural gasoline to create a mixture of 95% ethanol and 5% denaturant. The denaturing step will be conducted to comply with applicable Alcohol Tobacco Tax and Trade Bureau (TTB) requirements. Denaturant will also be stored within an internal floating roof tank (TF3). The denatured ethanol will be stored in one of two internal floating roof tanks (TF4 and TF5). Loading / Unloading of liquid product to both truck and railcars will be controlled with the use of an industrial flare (S9). Loading of DDGS will be completed within an enclosed building and vented to a high efficiency baghouse to control fugitive dust (S4).

Vapors from the various process equipment and vents used to process solids generated during the process (mixer; slurry, cook water, yeast and centrate tanks; and cook tube; and B/C condenser) will be ventilated to one (1) regenerative thermal oxidizer (RTO) for emissions control (S6). The thermal oxidizer serves to control volatile organic compounds (VOCs) / hazardous air pollutants (HAPs). The RTO also marginally controls PM / PM₁₀ emissions (including condensables).

The distillation process will remove the non-fermentable corn solids and water from the process stream. The residue mash leaving distillation, called whole stillage, will be transferred from the base of the beer column to the stillage processing area. The whole stillage will go into a whole stillage tank and then pass through a centrifuge to remove the majority of the water. The underflow from the centrifuge is called wet distillers grain and solubles (WDGS) or wet cake. The facility has the option to handle WDGS in three ways, at this point in the process:

1. The WDGS is high quality feed (about 65% moisture) and can be loaded directly to trucks and transported to customers. The WDGS can be stored on a pad, typically for 2 to 3 days, until transport.
2. The WDGS can be partially dried to create a product known as modified wet distillers grain and solubles (MWDGS) or modified wet cake. The product is approximately 50% moisture. One benefit of modified wet cake is the longer storage time.
3. The WDGS can be dried to create a product known as dried distillers grains and solubles (DDGS). The DDGS are about 10% moisture and can be stored for long periods of time. Upon leaving the drying system, the DDGS must be cooled prior to storage or loadout. The facility utilizes a single fluid bed cooler for DDGS cooling. The DDGS storage and loadout system is ventilated to a high efficiency baghouse for particulate emission control.

The DDGS drying operation will consist of a single direct-fired rotary dryer. The drying will be accomplished by direct contact with hot gases in the drum of the dryer. The emissions from the DDGS dryer will also be controlled by the RTO. The RTO will employ low NO_x burners. The anaerobic digester has two options for venting emissions, one via the dryer and the second is an Anaerobic Treatment Module (ATM) flare (S7). The emissions from the DDGS cooling system will be controlled by a high efficiency baghouse collection system (S3).

The overflow from the centrifuges, called thin stillage, will enter the centrate tank and then a thin stillage tank prior to passing through a set of evaporators. The evaporators will reduce water content and the gas portion will go to the RTO. The concentrated stream from the evaporators

will be mixed with the centrifuge underflow stream (or added later) before entering the dryer. The condensed water from the evaporators will go to the ATM. The ATM is an anaerobic biological water treatment system that will convert organic material in the process water into fuel gas (primarily methane) which supplements the fuel gas for the DDGS dryer. When the dryer is not in operation, the methane will be routed to the ATM's high efficiency flare system (**S7**). The water from the ATM will be recycled to the cook water tank for reuse in the process.

The facility will be equipped with a water cooling tower that provides non-contact cooling to various processes (**S11**).

The RTO will serve as the primary emission control device (**S6**) for the dryer and process vents. A RTO is very efficient at reducing PM, PM₁₀, carbon monoxide (CO), VOCs, HAPs, and the potential for nuisance odors. Finally, two (2) gas fired boilers (**S8**) will produce the steam to support plant fermentation operations. The boilers will exhaust through a common stack and employ low NO_x burners to minimize the NO_x emission rate.

The facility will incorporate emergency equipment as a safety precaution. The emergency equipment will consist of a 208 brake horsepower (bhp) #2 fuel oil-fired engine for the emergency fire water pump (**S10**), limited to 500 non-emergency hours operation per year. Non-emergency operating hours for the engine will include maintenance and testing activities. If there is an emergency that requires the fire water pump, it is expected that the rest of the facility will be shut down.

Since the emergency equipment will be fuel oil-fired, a fuel oil storage tank will be installed. The tank will have a capacity of 250 gallons or less. Due to the small tank size, low volume throughput, and low vapor pressure of #2 fuel oil, emissions associated with this tank are expected to be negligible.

COMMENTS:

The following equipment (or equivalent) is proposed (note that present tense may be used in the description, even though units are proposed):

1. Grain Receiving, Storing & Processing Facilities
 - a. Two (2) grain storage bins or silos of approximately 500,000 bushels of combined storage capacity.
 - b. Receiving equipment truck and rail (20,000 and 40,000 bushels/hr maximum capacity, respectively), one (1) day surge bin with a storage capacity of 5,000 bushels and two (2) hammermills (3,500 bushels/hr, combined capacity).
 - c. Equipment necessary for loading distiller's dried grains and solubles (DDGS) and wet cake into trucks and railcars for shipment off-site.
2. One (1) Ethanol Manufacturing Plant includes storage tanks, various pumps, piping and valves, fermentation process vessels, carbon dioxide scrubber, distillation units, molecular

sieves, condensers, centrifuges, evaporators, DDGS dryers, methanator and product loadout.

Specific Plant Equipments:

- a. One (1) Tank – 165,000 Gallons designed to store 190 proof (95%) ethanol. The tank is equipped with an interior floating roof and seal system that meets the applicable requirements of 40 CFR Part 60, Subpart Kb.
- b. One (1) Tank – 165,000 Gallons designed to store 200 proof (100%) ethanol. The tank is equipped with an interior floating roof and seal system that meets the applicable requirements of 40 CFR Part 60, Subpart Kb.
- c. One (1) Tank – 75,000 Gallons designed to store denaturant (natural gasoline). The tank is equipped with an interior floating roof and seal system that meets the applicable requirements of 40 CFR Part 60, Subpart Kb.
- d. Two (2) Tanks – 750,000 Gallons each designed to store product grade denatured ethanol. Each tank is equipped with an interior floating roof and seal system that meets the applicable requirements of 40 CFR Part 60, Subpart Kb.
- e. Piping, Pumps and Valves: Various pumps, valves and flanges designed for light liquid service. Piping, pumps and valves are constructed, operated and maintained in accordance with the applicable requirements of 40 CFR Part 60, Subpart VV.
- f. One (1) Dryer designed for drying the wet distillers grain (WDGS). The dryer is rated at a maximum heat input rate of 95 mmBtu per hour and a drying capacity of 66 tons/hour of DDGS.
- g. One (1) Truck/Railcar Loading Terminal designed for transferring denatured ethanol to trucks and railcar for shipment offsite. Truck and railcar loading utilize submerged filling and be equipped with a shared flare in order to reduce VOC emissions during truck and railcar loadout.
- h. One (1) Cooling Tower provides plant cooling requirement at a design water circulation rate of 27,000 gallons per minute.
- i. One Anaerobic Treatment Module (ATM) to include a flare. This unit treats process wastewater and produces methane. During normal operation, the produced methane is used a fuel in the dryer. The flare operates only when the dryer is down, i.e., when the produced fuel gas (primarily methane) will not be supplementing (or offsetting) fuel demand to the dryer.
- j. Plant Roads. All roads on plant property are paved.
- k. One (1) 18 mmBtu/hr Regenerative Thermal Oxidizer (RTO) serves as the primary emission control for the dryer as well as process vents.

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- l. Grain Receiving Area (truck/rail) designed to control emissions with pits ventilated to a 40,000 cfm baghouse.
- m. Mill Surge Bin two (2) Hammermills surge bin has a capacity of 5,000 bushels and along with conveyers and hammermills are ventilated to a 30,000 cfm baghouse.
- n. One (1) DDGS Cooling System and DDGS transport system designed to cool and transport DDGS in an enclosed storage building. Cooling system consists of a fluid bed cooler that exhausts through a 20,000 cfm baghouse to the atmosphere.
- o. One (1) DDGS Storage and Loadout designed to store and handle DDGS by truck/rail and controlled by a 2,400 cfm baghouse.
- p. One (1) Anhydrous Ammonia Storage Tank (18,000 gallon pressure vessel) has no specific air regulatory requirements.
- q. One (1) Corrosion Inhibitor Tank and Several Other Process Tanks are installed as required by various processes.

**Table 1. Air Emission Stack Parameters
Bluegrass Bioenergy, LLC
Fulton, Kentucky**

Emission Point ID	Source ID	Diameter (inches)	Height (feet)	Flow (acfm)	Temperature (degrees F)
S1	Unloading Baghouse	42	30	40,000	68 (Ambient)
S2	Milling Baghouse	38	30	30,000	68 (Ambient)
S3	Cooling System Baghouse	34	30	25,000	100
S4	DDGS Storage & Loadout Baghouse	10	25	1,800	100
S5	Degasser, Beer Well, and Fermenters	18	60	6,300	85
S6	Dryer/RTO Stack	64	100	86,000	336
S7	ATM Flare	17	30	Naturally aspirated	1,800

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S8	Package Boilers	60	50	55,000	350
S9	Loadout Flare (shared truck and railcar)	12	25	1,500	1,800
S10	Diesel Lean Burn Engine (300 hp)	3	15	953	815
S11	Cooling Tower	360	37	1,000,000	85

Type of control and efficiency:

1. One (1) Grain Unloading Fabric Filter Baghouse for the purpose of controlling particulate matter from grain unloading truck and rail pits, transfer, and the storage silos. The unit is designed for a 40,000 cubic feet per minute flow rate while operating at ambient temperature.
2. One (1) Hammermilling Fabric Filter Baghouse for the purpose of controlling particulate emissions from operation of the hammermills. The unit is designed for a 30,000 cubic feet per minute flow rate while operating at ambient temperature.
3. One (1) Fluid Bed Cooler with Fabric Filter Baghouse for the purpose of cooling the dried distillers grain and solubles prior to storage and load-out. The fluid bed cooler exhausts to a baghouse which is designed to operate at inlet and outlet gas flow rates of 25,000 cubic feet per minute.
4. One (1) DDGS Loadout Fabric Filter Baghouse for the purpose of collecting dust from the DDGS storage and loadout operation. The baghouse is designed to operate at 1,800 cfm.
5. One (1) CO₂ Scrubber for the purpose of removing residual ethanol prior to release of CO₂ and other gases to atmosphere.
6. One (1) Regenerative Thermal Oxidizer is fired with natural gas and designed for a maximum heat input rate of 18 mmBtu per hour. The exhaust emissions from the DDGS dryer, hydrolysis equipment, various tanks, distillation process, and stillage processes including some digester gases, are to be directed to the thermal oxidizer whenever the ethanol plant is operating. The thermal oxidizer minimizes potential for nuisance odor from the dryer and processes vents and provides particulate and VOC control.
7. One (1) ATM Flare for the purpose of controlling methane emissions from the anaerobic treatment module. The ATM gases are directed to the flare whenever the dryer is not operating.
8. One (1) Loadout Flare for the purpose of controlling VOC emissions from truck and railcar loadout of denatured ethanol.

Table 2. Emission Source and Control Equipment Inventory
Bluegrass Bioenergy, LLC
Fulton, Kentucky

Source ID#	Name / Description	Type of Control	Efficiency
S1	Grain Unloading	Baghouse	95%
S2	Grain Milling	Baghouse	95%
S3	DDGS Cooler	Baghouse	95%
S4	DDGS Loadout	Baghouse	95%
S5	Degasser, Beer Well, and Fermenters	CO ₂ Scrubber	95%
S6	Dryers / Various Processes	RTO	CO - 96% VOC - 98.5% PM ₁₀ - 90%
S7	Anaerobic Treatment Module (Normal operation - emission to S6)	Flare	98%
S8	Package Boilers	--	
S9	Product Loadout	Flare	97%
S10	Emergency Firewater Pump	--	
S11	Cooling Tower with Mist Eliminators	--	
Area 1	Wet Cake Storage / Handling	--	
Area 2	Ammonia Tank	--	
Area 3	Fugitives	LDAR	
Area 4	Paved Roads	--	
Area 5	Various Process Vents	--	

Emission factors and their source:

The Bluegrass ethanol facility has calculated maximum emissions with emission factors based on AP-42, manufacturer's guarantees, and engineering analysis. In addition, The TANK 4.09 software program was used to perform tank emissions calculations. The plant emissions are based on the following the facility conditions.

1. The maximum denatured throughput is 60 million gallon per year (mmgpy).
2. One dryer is installed to dry 100% of the wet cake & syrup.
3. CO₂ produced by fermentation is scrubbed to remove ethanol and vented to atmosphere.
4. An RTO system is sized and installed to control emissions from the DDGS dryer & process vents.
5. All plant roads are paved.
6. Steam is supplied by two (2) natural gas fired packaged boilers.
7. Ethanol loadout is assumed to be primarily by truck but will be by railcar also.
8. Ethanol unloading emissions assumes that 100% of denatured ethanol is shipped by truck and that all trucks previously carried gasoline.
9. DDGS dryers & RTO use natural gas as the fuel for the flame (methane produced in the ATM).
10. SO₂ emissions from dryers are predominantly process related.

Applicable regulations:

401 KAR 59:010, *New process operations*, is applicable to an emissions unit commenced on or after July 2, 1975.

401 KAR 59:015, *New indirect heat exchangers*, is applicable to an emissions unit with a capacity of less than 250 mmBtu/hr which commenced on or after April 9, 1972.

401 KAR 63:010, *Fugitive Emissions*, is applicable to each affected facility as an apparatus, operation, or road which emits or may emit fugitive emissions provided that the fugitive emissions from such facility are not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

401 KAR 63:015, *Flares*, is applicable to an emissions unit which means a device at the tip of a stack or other opening used for the disposal of waste gas streams by combustion.

- 401 KAR 63:020, *Potentially hazardous matter or toxic substances*, is applicable to an emissions unit which emits or may emit potentially hazardous matter or toxic substances, provided such emissions are not elsewhere subject to the provisions of the administrative regulations of the Division for Air Quality.
- 40 CFR 60 Subpart Dc, *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*, is applicable to the package boilers (S8) since each boiler for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 mmBtu/hr) or less, but greater than or equal to 2.9 MW (10 mmBtu/hr). The DDGS dryer and the RTO are not steam generating units, and therefore, are not subject to this regulation.
- 40 CFR 60 Subpart Kb, *Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984*, is applicable to storage tanks since which storage vessel has a capacity greater than 75 cubic meters (19,812.9 gallon) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.
- 40 CFR 60 Subpart VV, *Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry*, is applicable to affected facilities in the synthetic organic chemicals manufacturing industry that commences construction or modification after January 5, 1981. The Subpart VV regulates emissions of VOCs from equipment leaks (valves, flanges, pump seals, etc).

Regulations not applicable:

40 CFR 60 Subpart DD, *Standards of Performance for Grain Elevators*, is not applicable to the Bluegrass ethanol plant. Under Subpart DD, a “grain storage elevator” is defined as having a permanent storage capacity in excess of 1 million bushels at any dry corn mill (human consumption). The Bluegrass plant grain storage system is not applicable to the “grain storage elevator” definition. Further, the total grain storage capacity at Bluegrass is designed at less than 2.5 million bushels.

Ethanol plants that utilize grain feedstocks, and therefore, are not covered by NSPS regulations applicable to the synthetic organic chemical manufacturing industry (SOCMI), including Subpart RRR (SOCMI reactor process), Subpart NNN (SOCMI distillation process), and the proposed Subpart YYY (SOCMI wastewater systems).

EMISSION AND OPERATING CAPS DESCRIPTION:

In order to ensure that the facility remains exempt from the regulations for major sources of criteria and hazardous air pollutant (HAP) emissions, Bluegrass is requesting a conditional major permit. Emissions will be limited to less than 92.40 ton/yr volatile organic compounds (VOC), 22.5 ton/yr of total HAP, and 9 ton/yr of an individual HAP. Bluegrass has also requested source-wide limits for PM, PM₁₀, SO₂, NO_x, and CO. Monthly and rolling 12-month total emissions will be calculated. Emission calculations and supporting documentation will be retained at the facility.

PERIODIC MONITORING:

See the permit for Specific Monitoring Requirements, which include the grain processed rate; fuel grade ethanol production rate; monitoring of the RTO, flare, and scrubber; and 40 CFR 60 VV compliance monitoring for fugitives.

OPERATIONAL FLEXIBILITY:

None

CREDIBLE EVIDENCE:

This permit contains provisions which require that specific test methods, monitoring or recordkeeping be used as a demonstration of compliance with permit limits. On February 24, 1997, the U.S. EPA promulgated revisions to the following federal regulations: 40 CFR Part 51, Sec. 51.212; 40 CFR Part 52, Sec. 52.12; 40 CFR Part 52, Sec. 52.30; 40 CFR Part 60, Sec. 60.11 and 40 CFR Part 61, Sec. 61.12, that allow the use of credible evidence to establish compliance with applicable requirements. At the issuance of this permit, Kentucky has only adopted the provisions of 40 CFR Part 60, Sec.60.11 and 40 CFR Part 61, Sec. 61.12 into its air quality regulations.